

## **REMARKS**

### **Allowable Subject Matter**

Applicants gratefully acknowledge the Examiner's indication that the claims recite allowable subject matter. See pages 8-9 of the Office Action.

### **Restriction**

At pages 2-3 of the Office Action, the Examiner states that the Restriction is being maintained, i.e., is being made final. However, in doing so, the Examiner mischaracterizes applicants' comments. The Examiner states that applicants argued that "the different heterocyclic rings are "equivalent" and that "the rings are chemically equivalent. This is incorrect. In the Restriction, the Examiner had argued that the heterocyclic groups were not equivalent and applicants' responded by stating that this assertion was not supported. In making the Restriction, it is incumbent upon the Examiner to support the basis for restricting the claims. In any event, applicants argued in the prior Reply that an alleged lack of equivalence is not a basis for restriction.

One can easily argue that any two compounds are not equivalent. Even methane and ethane are not equivalent in all aspects, e.g., boiling points differ and reactivities differ. Even the halogens, a clearly recognized class of chemical entities, exhibit differing reactivities. Thus, the arguments presented in the most recent Office Action concerning differing reactivities do not, by themselves, establish a basis for restriction. No authority is provided to support an allegation that any difference in reactivity would support a finding of proper restriction. If that was all that was needed, then examination would always be limited to a single compound since one could always allege that two compounds exhibit some difference in reactivity.

The Examiner also argues that non-equivalence is "prima facie established by differing classifications" citing MPEP §803. Here again, merely arguing lack of equivalence does not establish a basis for Restriction. Moreover, contrary to the Examiner's assertion, MPEP §803 does say anything about non-equivalence based on different classification. In fact, MPEP §803 never mentions equivalence. '

The Office Action also asserts that triazine is not a heterocycle found in naturally occurring nucleosides and that oxathiolanes are not naturally occurring sugars. But, there is nothing to indicate that biochemists deal only with naturally occurring nucleosides and completely ignore nucleoside analogues. In any event, whether the person of ordinary skill in the art is a biochemist working in nucleoside analogues or an organic chemist dealing with nucleosides analogues, the Restriction Requirement does not demonstrate why one of ordinary skill would consider the group of heterocyclic rings recited in the claims to be repugnant to scientific classification in the field of nucleoside analogues. Withdrawal of the Restriction is again respectfully requested.

### **Claim Objections**

Formulas in claims 35, 45, 55, 63, 74 and 75 of heterocyclic groups  $R_2$  have been amended to correct obvious typographical errors. See, for example, the formulas at pages 4-6 of Applicants' specification. In addition, in claims 63, 64 and 75, the formula previously labeled as XVI is now identified as formula XIV. See, e.g. scheme 1 at page 13. It is noted the text of these claims refer to formula XIV, rather than formula XVI.

In view of the above remarks, withdrawal of the objections to the claims is respectfully requested.

### **Rejection Under 35 USC §112, second paragraph**

In the rejection, it is asserted that the terms "thiol, thiolalky and thioaryl" are indefinite. Applicants respectfully disagree.

All of these are common terms within the chemical art and well known to one of ordinary skill in the art. With regards to "thiol," the Examiner has suggested replacing this term with "mercapto." However, this change is unnecessary, since one of ordinary skill in the art recognizes these terms mean the same thing. See, for example, the attached excerpt from Grant & Hackh's Chemical Dictionary, 5<sup>th</sup> edition (1987), wherein at page 360 "mercapto" is identified as a prefix indicating a "thiol" group, i.e. -SH. Thus, one of ordinary skill in the art would recognize that the term "thiol," as used in Applicant's claims, refers to the radical -SH.

Similarly, one of ordinary skill in the art would recognize that "thio" typically means replacement of oxygen by a divalent sulphur, and that "alkyl" refers to a monovalent alkyl

radical. Therefore, one would recognize that “thioalkyl” refers to an alkoxy radical in which -O- is replaced by -S-. Similarly, one of ordinary skill in the art would recognize that “thioaryl” refers to an aryloxy radical in which -O- is replaced by -S-. The naming of such groups with the “thio” portion listed first is common. See for example the compounds listed in Hackh’s, which begin with the prefix “thio”, e.g., thiocarbamoyl (-SCNHS<sub>2</sub>) and thiophenyl (PhS-). Moreover, these terms are known within the art of nucleoside analogue chemistry. See, for example, Liotta et al.(U.S. 5, 204,466) at column 4, lines 67-68, column 5, lines 20-21 and column 7, line 28-29; Since these terms are known with in the art, it is unnecessary to switch the parts of the name around to be alkylthio and arylthio as suggested by the Examiner.

In view of the above remarks, it is respectfully submitted that the terms “thiol”, thioaryl, and thioakyl,” as used in Applicants’ claims, are more than sufficiently definite to one of ordinary skill in the art.

In claims 37, 38, 65 and 66, the phrase “aliphatic or aromatic C<sub>1-6</sub> acyl” has been replaced by C<sub>1-6</sub> aliphatic acyl, aromatic acyl.” See, for example, page 11, lines 3-4 of Applicants’ specification.

In view of the above remarks, withdrawal of the rejection under 35 U.S.C. §112, second paragraph, is respectfully requested.

#### **Rejection Under 35 USC §112, first paragraph**

By the above amendments, formula XVI in claims 35, 36, 45, 46, 55, 56, and 74 has been amended to correct a typographical error, i.e., R<sub>7</sub> has been changed to R<sub>y</sub>. See page 18 of Applicant’s specification.

In addition, claims 45 and 46 are amended above to indicate that formula XXIII has the side chain R<sub>1</sub>OCH<sub>2</sub>, rather than R<sub>y</sub>O<sub>2</sub>C. See, e.g., formula XXIII at page 23 of the specification.

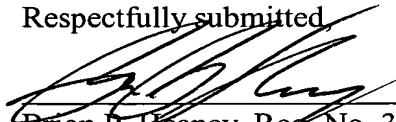
Further, Applicants have amended claim 46 to also correct an obvious typographical error. Thus, formula XVII is amended to show the side chain R<sub>y</sub>O<sub>2</sub>C, rather than R<sub>7</sub>O<sub>2</sub>C. See, e.g., scheme 2 at page 18 of the specification.

In view of the above remarks, withdrawal of the rejection under 35 U.S.C. §112, first paragraph, is respectfully requested.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned **"Version With Markings To Show Changes Made"**.

The Commissioner is hereby authorized to charge any fees associated with this response or credit any overpayment to Deposit Account No. 13-3402.

Respectfully submitted,

  
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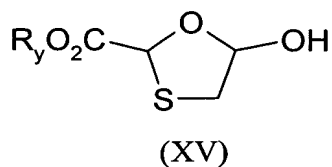
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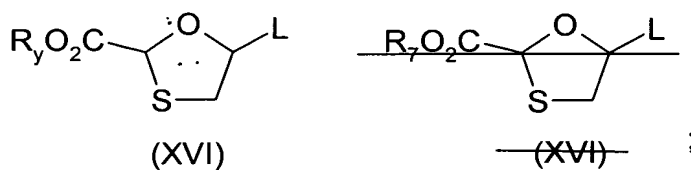
IN THE CLAIMS:

--35. A process comprising:

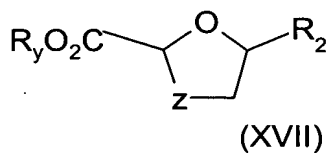
reacting a mercaptoacetaldehyde with a compound of formula  $R_y\text{OOCCHO}$ , wherein  $R_y$  is  $C_{1-12}$  alkyl or  $C_{6-20}$  aryl to obtain a compound of formula (XV)



converting the hydroxyl group of the compound of formula (XV) to a leaving group L to obtain a compound of formula (XVI):



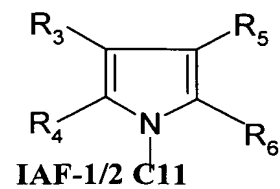
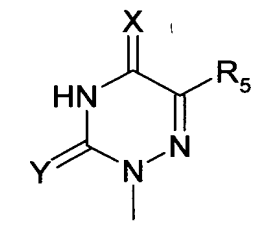
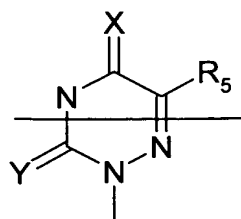
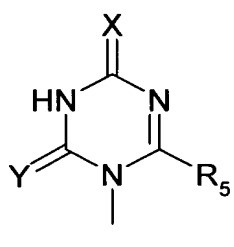
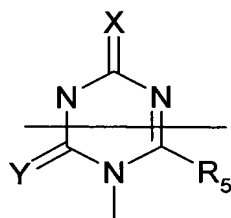
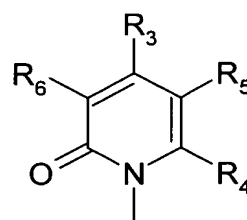
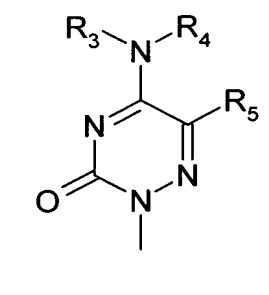
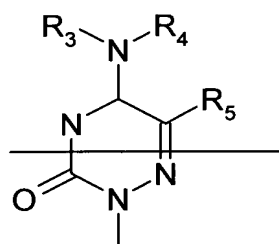
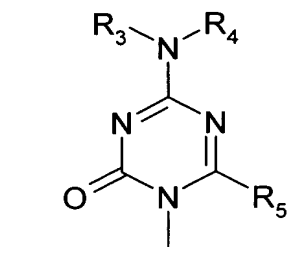
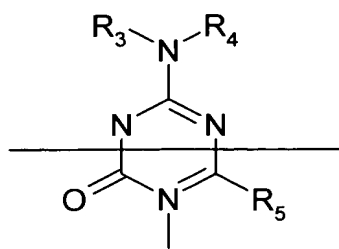
reacting the compound of formula (XVI) with a silylated  $R_2$ - compound, in the presence of a Lewis acid, whereby said leaving group is displaced, to produce a compound of formula (XVII):

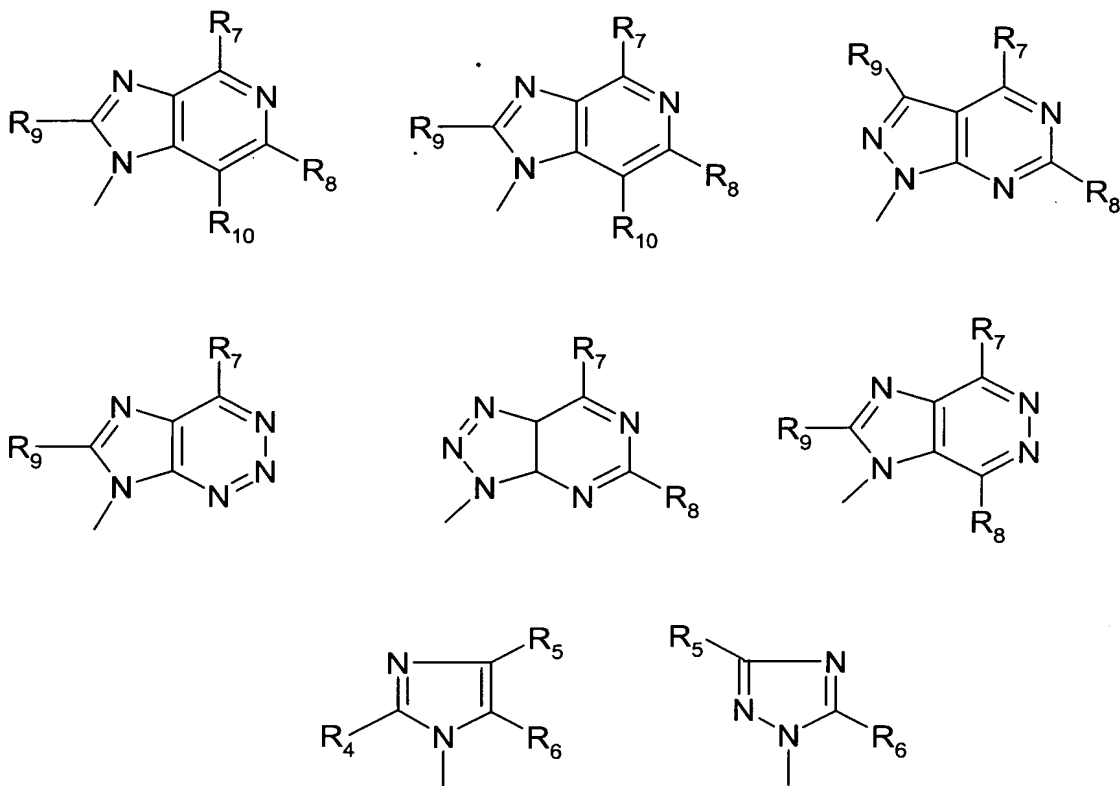


wherein

Z is S;

R<sub>2</sub> is selected from the following group:





X is oxygen or sulfur;

Y is oxygen or sulfur;

R<sub>3</sub> and R<sub>4</sub> are independently selected from hydrogen, hydroxyl, amino, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyl or aracyl;

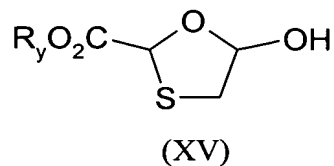
R<sub>5</sub> and R<sub>6</sub> are independently selected hydrogen, halogen, hydroxyl, amino, cyano, carboxy, carbamoyl, alkoxy, carbonyl, hydroxymethyl, trifluoromethyl, thioaryl, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy;

R<sub>7</sub> and R<sub>8</sub> are independently selected from hydrogen, hydroxy, alkoxy, thiol, thioalkyl, amino, halogen, cyano, carboxy, alkoxy, carbonyl, carbamoyl, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy; and

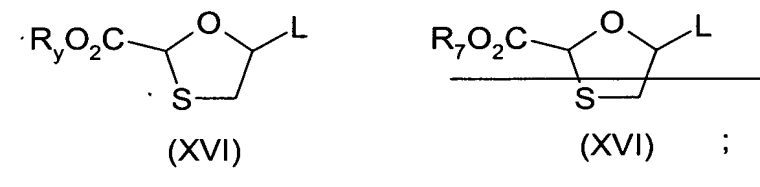
R<sub>9</sub> and R<sub>10</sub> are independently selected from the hydrogen, hydroxy, alkoxy, amino, halogen, azido, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy.

36. A process comprising:

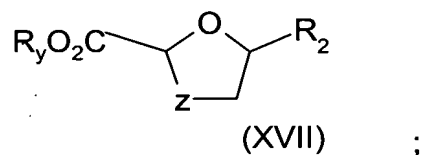
reacting a mercaptoacetaldehyde with a compound of formula  $R_y\text{OOCCHO}$ , wherein  $R_y$  is  $\text{C}_{1-12}$  alkyl or  $\text{C}_{6-20}$  aryl to obtain a compound of formula (XV)



converting the hydroxyl group of the compound of formula (XV) to a leaving group L to obtain a compound of formula (XVI):



reacting the compound of formula (XVI) with a silylated  $R_2$ - compound, in the presence of a Lewis acid, whereby said leaving group is displaced, to produce a compound of formula (XVII):

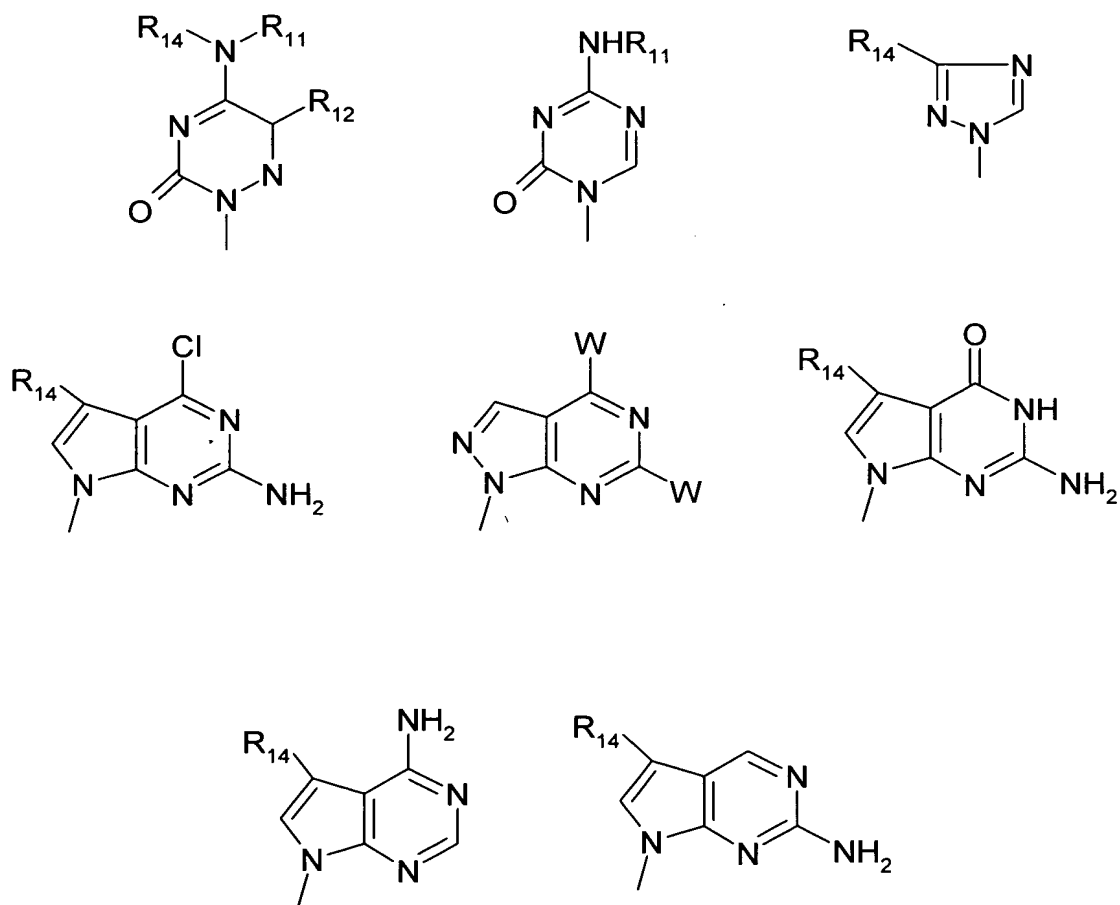


wherein

$Z$  is S;

$R_2$  is selected from the following group:





wherein

each  $R_{11}$  is independently selected from hydrogen, acetyl, and  $C_{1-6}$  alkyl;

$R_{12}$  and  $R_{13}$  are independently selected from hydrogen, hydroxymethyl, trifluoromethyl,  $C_{1-6}$  alkyl,  $C_{1-6}$  alkenyl, bromine, chlorine, fluorine, and iodine;

$R_{14}$  is selected from hydrogen, cyano, carboxy, ethoxycarbonyl, carbamoyl, and thiocarbamoyl; and

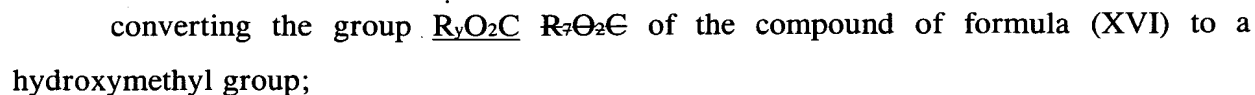
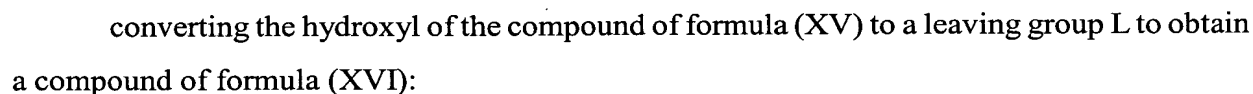
each  $W$  is independently selected from hydrogen, bromine, chlorine, fluorine, iodine, amino, and hydroxyl.

37. A process according to claim 35, wherein  $L$  is  $OR_z$ , wherein  $R_z$  is selected from:  $C_{1-6}$  alkyl groups,  $C_{1-6}$  aliphatic groups, or aromatic  $C_{1-6}$  acyl groups, saturated or

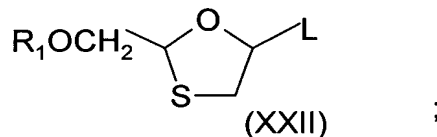
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**38.** A process according to claim 36, wherein L is OR<sub>z</sub>, wherein R<sub>z</sub> is selected from: C<sub>1-6</sub> alkyl groups, C<sub>1-6</sub> aliphatic groups, ~~or~~ aromatic C<sub>1-6</sub> acyl groups, saturated or unsaturated alkoxycarbonyl groups, sulphonyl imidazolidine, carbonyl imidazolidine, aliphatic or aromatic amino carbonyl groups, alkyl imidate groups, saturated or unsaturated phosphinoyl, and aliphatic or aromatic sulphonyl groups.

reacting a mercaptoacetaldehyde with a compound of formula  $R_y\text{OOCCHO}$ , wherein  $R_y$  is  $\text{C}_{1-12}$  alkyl or  $\text{C}_{6-20}$  aryl to obtain a compound of formula (XV)

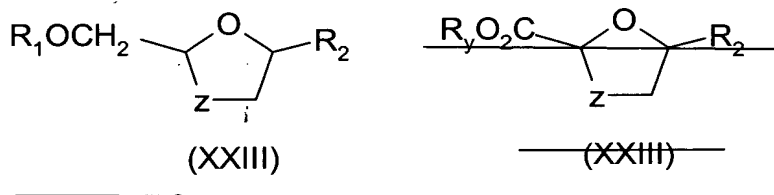


protecting the resulting hydroxymethyl with a protecting function  $R_1$  to obtain a compound of formula (XXII):



wherein  $R_1$  is selected from the group consisting of  $C_{1-16}$  acyl, t-butyldimethylsilyl, and t-butyldiphenylsilyl;

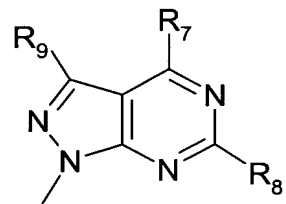
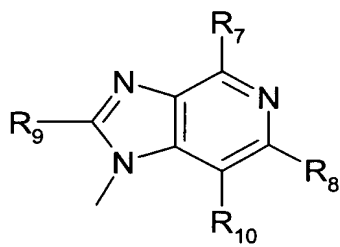
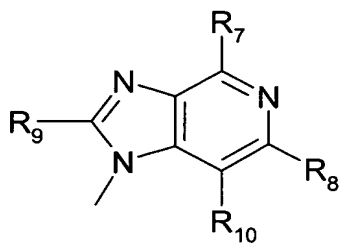
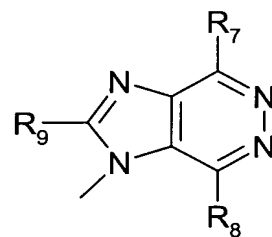
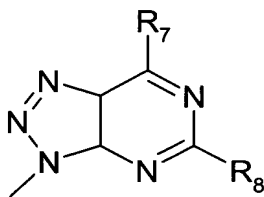
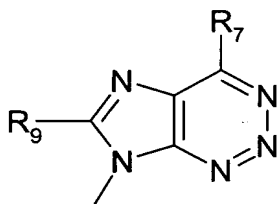
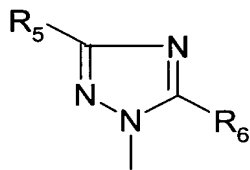
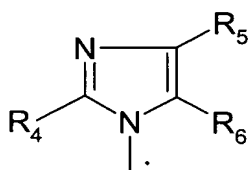
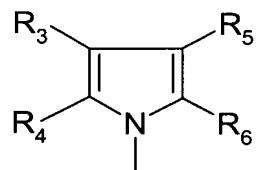
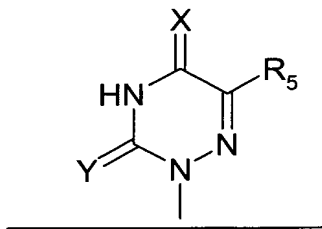
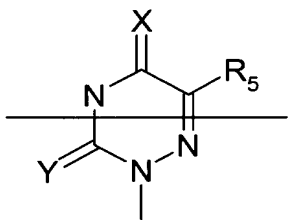
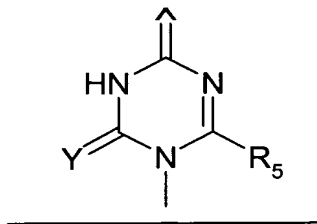
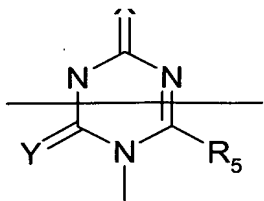
reacting the compound of formula (XXII) with a silylated- $R_2$  compound, in the presence of a Lewis acid, whereby said leaving group is displaced, to obtain a compound of formula (XXIII):



wherein

$Z$  is S;

$R_2$  is selected from the following group:



X is oxygen or sulfur;

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Y is oxygen or sulfur;

R<sub>3</sub> and R<sub>4</sub> are independently selected from hydrogen, hydroxyl, amino, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyl or aracyl;

R<sub>5</sub> and R<sub>6</sub> are independently selected hydrogen, halogen, hydroxyl, amino, cyano, carboxy, carbamoyl, alkoxycarbonyl, hydroxymethyl, trifluoromethyl, thioaryl, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy;

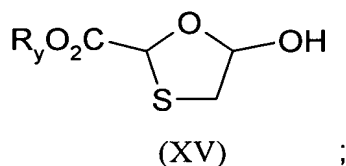
R<sub>7</sub> and R<sub>8</sub> are independently selected from hydrogen, hydroxy, alkoxy, thiol, thioalkyl, amino, halogen, cyano, carboxy, alkoxycarbonyl, carbamoyl, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy; and

R<sub>9</sub> and R<sub>10</sub> are independently selected from the hydrogen, hydroxy, alkoxy, amino, halogen, azido, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy; and

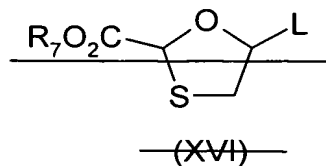
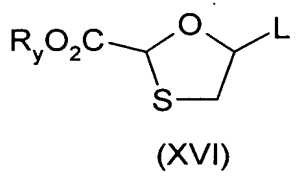
optionally further comprising oxidizing Z of said compound of formula (XXIII) to obtain a compound of formula (XXIII) wherein Z is S=O or SO<sub>2</sub>.

**46.** A process comprising:

reacting a mercaptoacetaldehyde with a compound of formula R<sub>y</sub>OOCCHO, wherein R<sub>y</sub> is C<sub>1-12</sub> alkyl or C<sub>6-20</sub> aryl to obtain a compound of formula (XV)

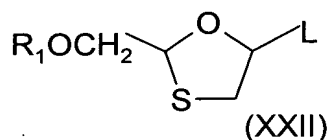


converting the hydroxyl of the compound of formula (XV) to a leaving group L to obtain a compound of formula (XVI):



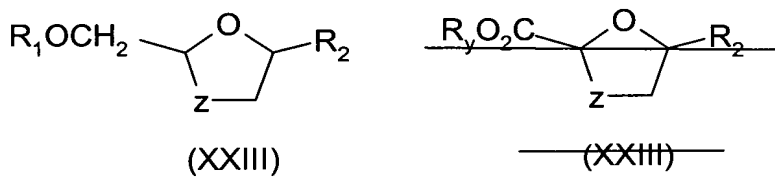
converting the group  $\text{R}_y\text{O}_2\text{C}$   $\text{R}_z\text{O}_2\text{C}$  of the compound of formula (XVI) to a hydroxymethyl group;

protecting the resulting hydroxymethyl with a protecting function  $\text{R}_1$  to obtain a compound of formula (XXII):



wherein  $\text{R}_1$  is selected from the group consisting of  $\text{C}_{1-16}$  acyl, t-butyldimethylsilyl, and t-butyldiphenylsilyl;

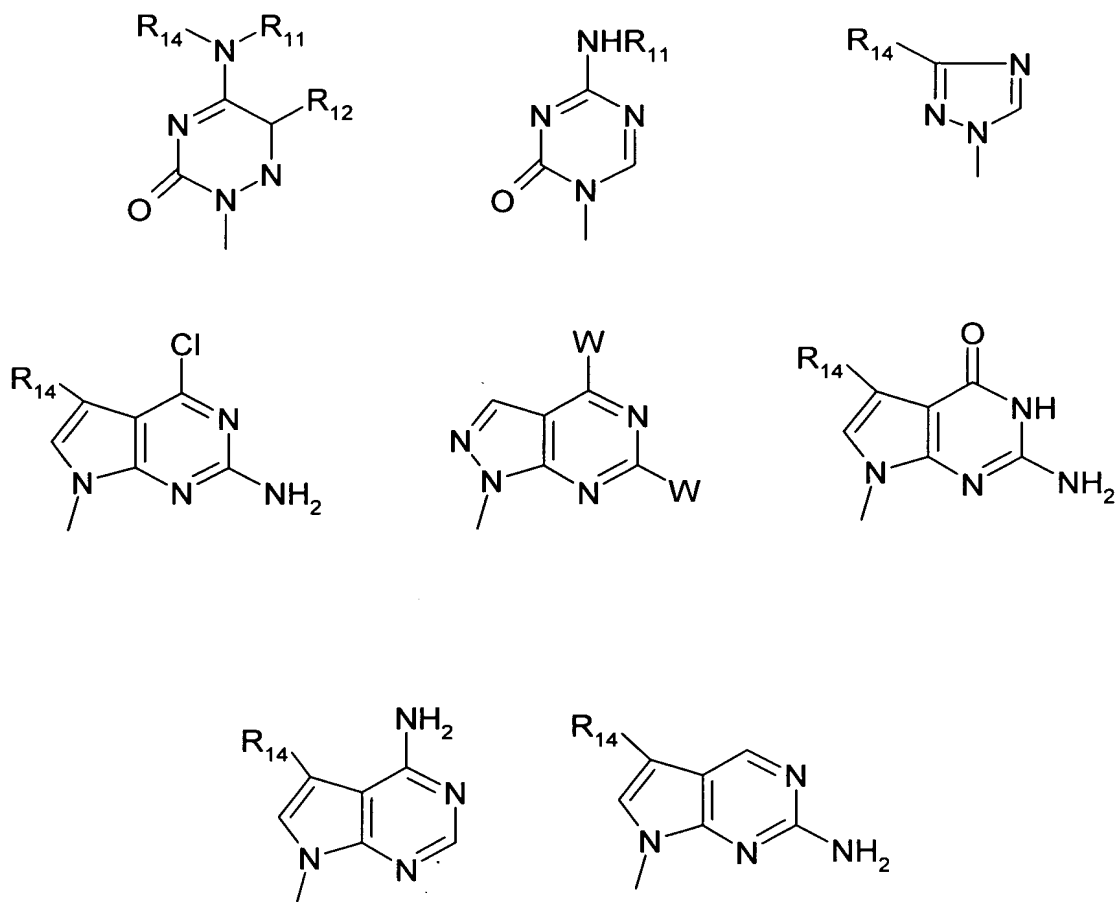
reacting the compound of formula (XXII) with a silylated- $\text{R}_2$  compound, in the presence of a Lewis acid, whereby said leaving group is displaced, to obtain a compound of formula (XXIII):



wherein

$\text{Z}$  is S;

$\text{R}_2$  is selected from the following group:



wherein

each  $R_{11}$  is independently selected from hydrogen, acetyl, and  $C_{1-6}$  alkyl;

$R_{12}$  and  $R_{13}$  are independently selected from hydrogen, hydroxymethyl, trifluoromethyl,  $C_{1-6}$  alkyl,  $C_{1-6}$  alkenyl, bromine, chlorine, fluorine, and iodine;

$R_{14}$  is selected from hydrogen, cyano, carboxy, ethoxycarbonyl, carbamoyl, and thiocarbamoyl; and

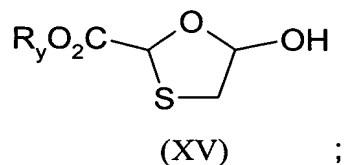
each  $W$  is independently selected from hydrogen, bromine, chlorine, fluorine, iodine, amino, and hydroxyl; and

optionally further comprising oxidizing  $Z$  of said compound of formula (XXIII) to obtain a compound of formula (XXIII) wherein  $Z$  is  $S=O$  or  $SO_2$ .

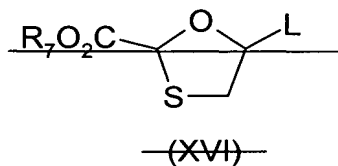
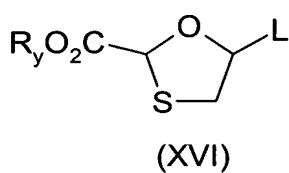
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55. A process comprising:

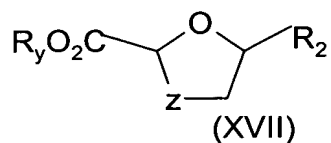
reacting a mercaptoacetaldehyde with a compound of formula  $R_y\text{OOCCHO}$ , wherein  $R_y$  is  $C_{1-12}$  alkyl or  $C_{6-20}$  aryl to obtain a compound of formula (XV)



converting the hydroxyl of the compound of formula (XV) to a leaving group L to obtain a compound of formula (XVI):



reacting the compound of formula (XVI) with a silylated  $-R_2$  compound in the presence of a Lewis acid, whereby said leaving group is displaced, to produce a compound of formula (XVII):

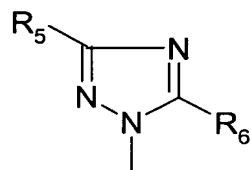
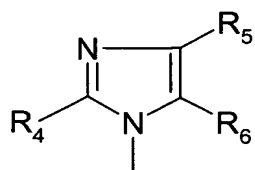
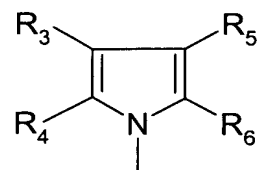
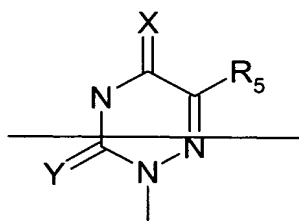
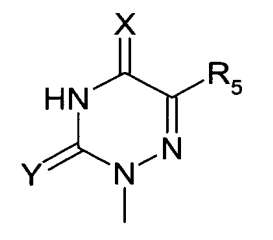
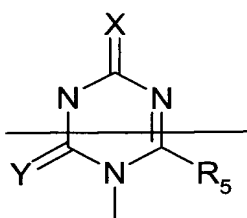
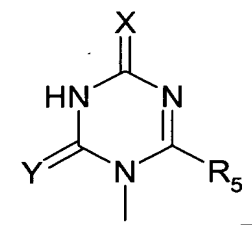


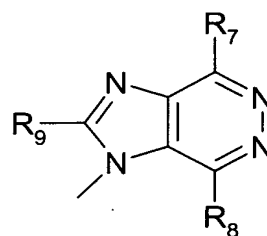
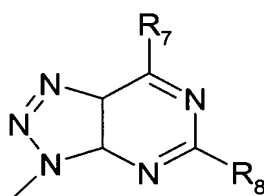
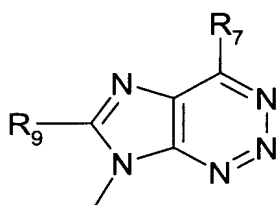
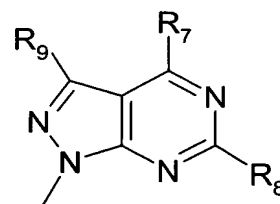
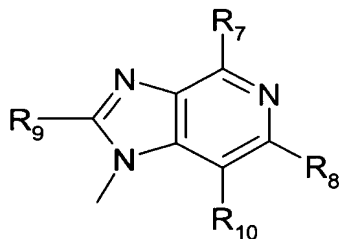
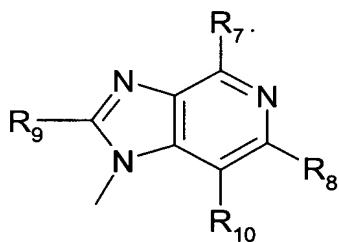
wherein



Z is S;

R<sub>2</sub> is selected from the following group:





X is oxygen or sulfur;

Y is oxygen or sulfur;

R<sub>3</sub> and R<sub>4</sub> are independently selected from hydrogen, hydroxyl, amino, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyl or aracyl;

R<sub>5</sub> and R<sub>6</sub> are independently selected hydrogen, halogen, hydroxyl, amino, cyano, carboxy, carbamoyl, alkoxycarbonyl, hydroxymethyl, trifluoromethyl, thioaryl, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy;

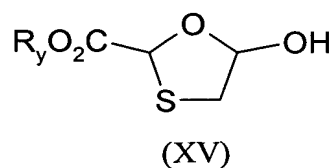
R<sub>7</sub> and R<sub>8</sub> are independently selected from hydrogen, hydroxy, alkoxy, thiol, thioalkyl, amino, halogen, cyano, carboxy, alkoxycarbonyl, carbamoyl, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy; and

R<sub>9</sub> and R<sub>10</sub> are independently selected from the hydrogen, hydroxy, alkoxy, amino, halogen, azido, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy.

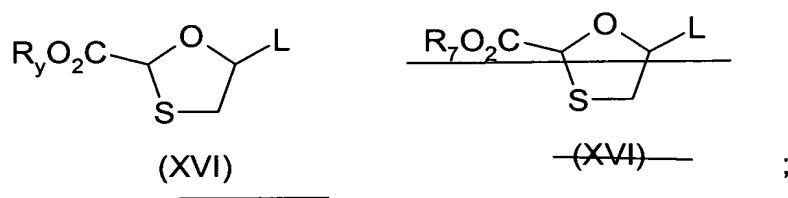
56. A process comprising:

reacting a mercaptoacetaldehyde with a compound of formula R<sub>y</sub>OOCCHO, wherein R<sub>y</sub> is C<sub>1-12</sub> alkyl or C<sub>6-20</sub> aryl to obtain a compound of formula (XV)

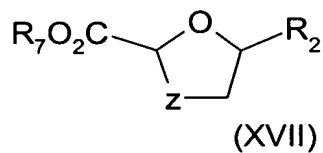
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converting the hydroxyl of the compound of formula (XV) to a leaving group L to obtain a compound of formula (XVI):



reacting the compound of formula (XVI) with a silylated -R<sub>2</sub> compound in the presence of a Lewis acid, whereby said leaving group is displaced, to produce a compound of formula (XVII):

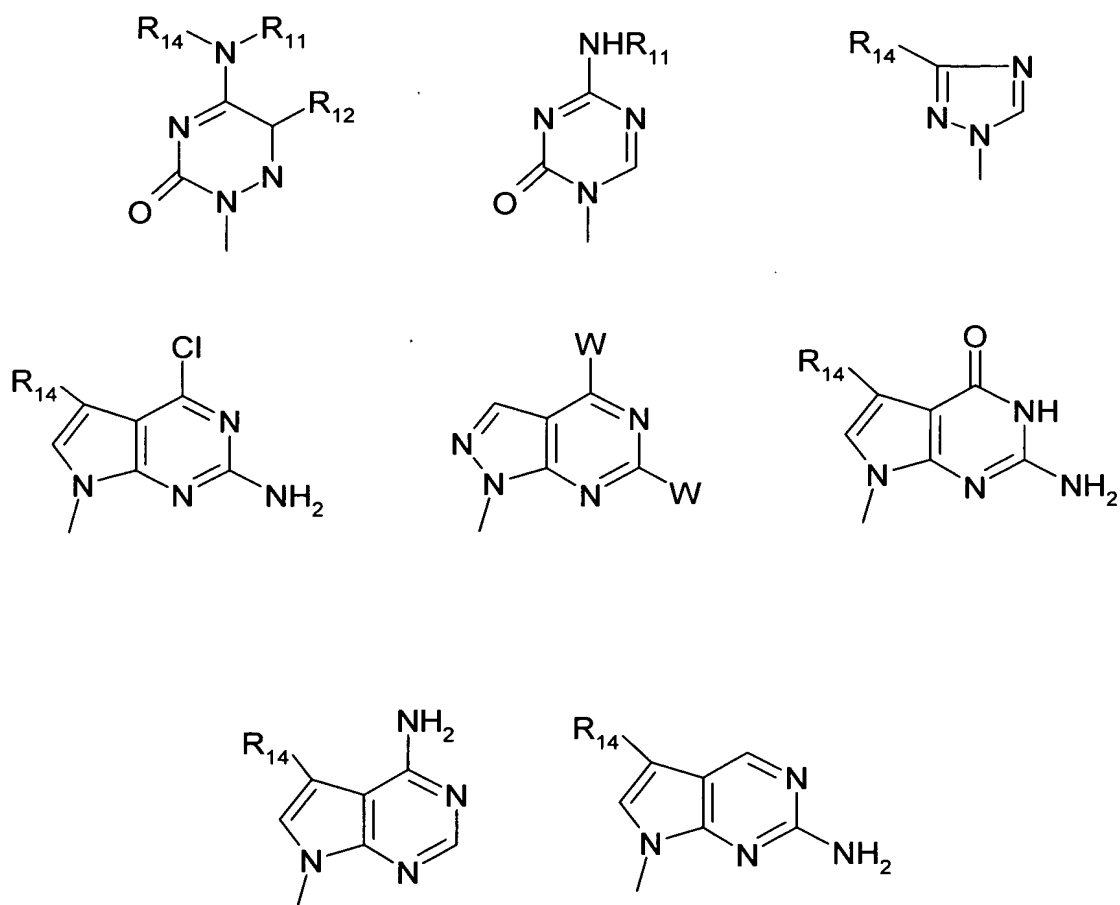


wherein

Z is S;

R<sub>2</sub> is selected from the following group:

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each  $R_{11}$  is independently selected from hydrogen, acetyl, and  $C_{1-6}$  alkyl;

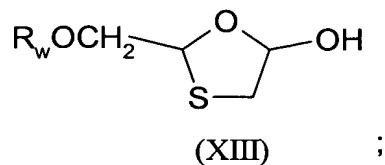
$R_{12}$  and  $R_{13}$  are independently selected from hydrogen, hydroxymethyl, trifluoromethyl,  $C_{1-6}$  alkyl,  $C_{1-6}$  alkenyl, bromine, chlorine, fluorine, and iodine;

$R_{14}$  is selected from hydrogen, cyano, carboxy, ethoxycarbonyl, carbamoyl, and thiocarbamoyl; and

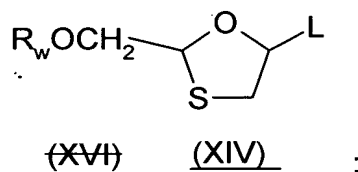
each  $W$  is independently selected from hydrogen, bromine, chlorine, fluorine, iodine, amino, and hydroxyl.

**63.** A process comprising:

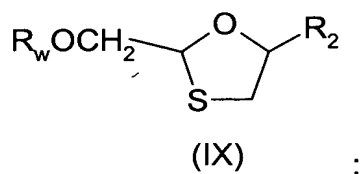
reacting a mercaptoacetaldehyde with a compound of formula  $R_wOCH_2CHO$ , under neutral or basic conditions, wherein  $R_w$  is hydrogen or a hydroxyl protecting group to obtain a compound of formula (XIII)



converting the hydroxyl of the compound of formula (XIII) to a leaving group L to obtain a compound of formula (XIV):



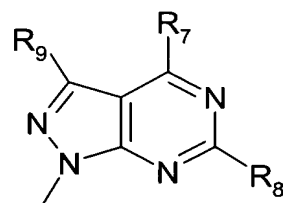
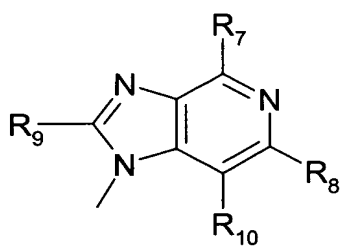
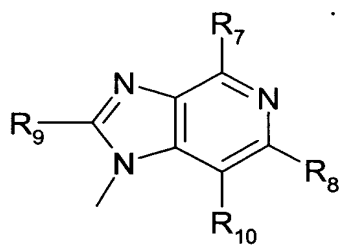
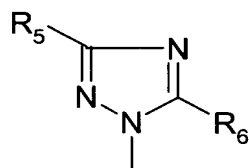
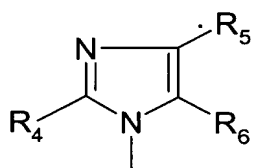
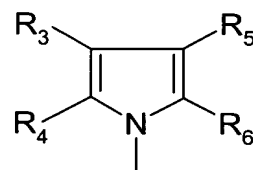
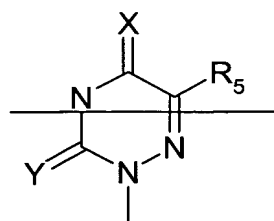
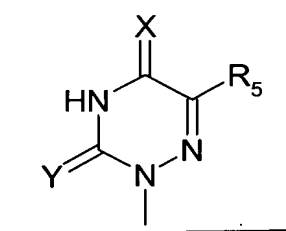
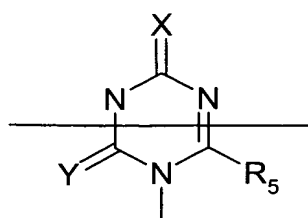
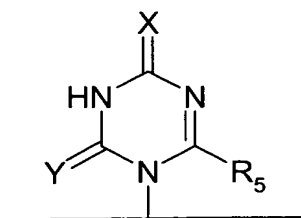
reacting the compound of formula (XIV) with a silylated purine or pyrimidine base or derivative thereof  $R_2$ , in the presence of a Lewis acid, said leaving group is displaced, to produce a compound of formula (IX):



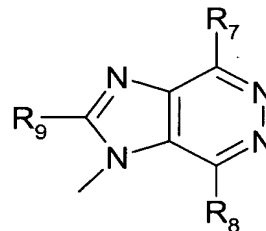
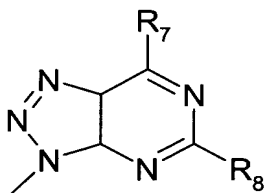
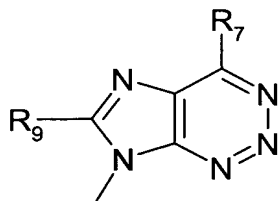
wherein

$Z$  is S, and

$R_2$  is selected from the following group:



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X is oxygen or sulfur; Y is oxygen or sulfur;

R<sub>3</sub> and R<sub>4</sub> are independently selected from the group consisting of hydrogen, hydroxyl, amino, substituted or unsubstituted C<sub>1-6</sub> alkyl or C<sub>2-6</sub> alkenyl or C<sub>2-6</sub> alkynyl, and substituted or unsubstituted C<sub>1-10</sub> acyl or aracyl;

R<sub>5</sub> and R<sub>6</sub> are independently selected from the group consisting of hydrogen, halogen, hydroxyl, amino, cyano, carboxy, carbamoyl, alkoxycarbonyl, hydroxymethyl, trifluoromethyl, thioaryl, substituted or unsubstituted C<sub>1-6</sub> alkyl or C<sub>2-6</sub> alkenyl or C<sub>2-6</sub> alkynyl, and substituted or unsubstituted C<sub>1-10</sub> acyloxy;

R<sub>7</sub> and R<sub>8</sub> are independently selected from the group consisting of hydrogen, hydroxy, alkoxy, thiol, thioalkyl, amino, substituted amino, halogen, cyano, carboxy, alkoxycarbonyl, carbamoyl, substituted or unsubstituted C<sub>1-6</sub> alkyl, or C<sub>2-6</sub> alkenyl, or C<sub>2-6</sub> alkynyl, and substituted or unsubstituted C<sub>1-10</sub> acyloxy; and

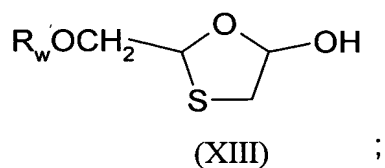
R<sub>9</sub> and R<sub>10</sub> are independently selected from the group consisting of hydrogen, hydroxy, alkoxy, amino, substituted amino, halogen, azido, substituted or unsubstituted C<sub>1-6</sub> alkyl or C<sub>2-6</sub> alkenyl or C<sub>2-6</sub> alkynyl, and substituted or unsubstituted C<sub>1-10</sub> acyloxy+ and

optionally further comprising oxidizing Z of said compound of formula (IX) to obtain a compound of formula (IX) wherein Z is S=O or SO<sub>2</sub>.

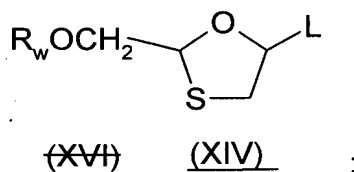
#### 64. A process comprising:

reacting a mercaptoacetaldehyde with a compound of formula R<sub>w</sub>OCH<sub>2</sub>CHO, under neutral or basic conditions, wherein R<sub>w</sub> is hydrogen or a hydroxyl protecting group to obtain a compound of formula (XIII)

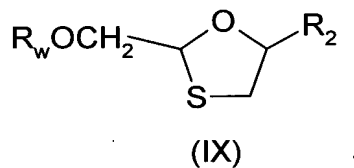
IAF-1/2 C11



converting the hydroxyl of the compound of formula (XIII) to a leaving group L to obtain a compound of formula (XIV):



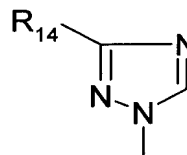
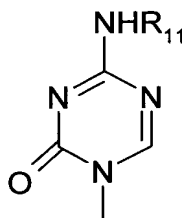
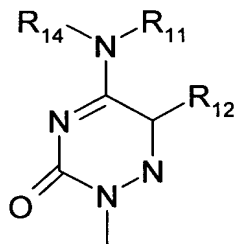
reacting the compound of formula (XIV) with a silylated purine or pyrimidine base or derivative thereof R<sub>2</sub>, in the presence of a Lewis acid, said leaving group is displaced, to produce a compound of formula (IX):



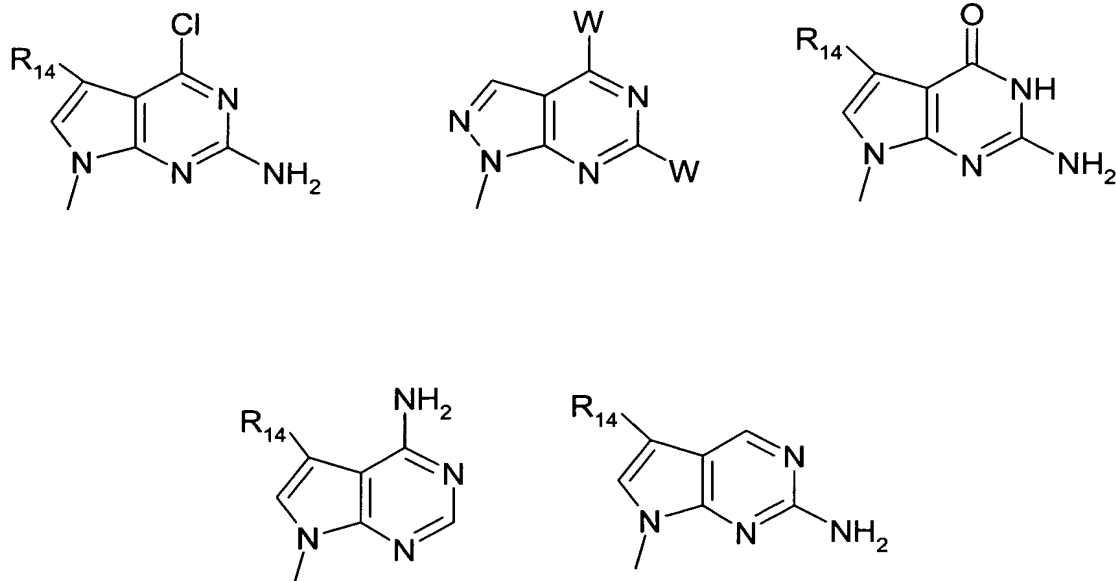
wherein

Z is S, and

R<sub>2</sub> is selected from the following group:







each  $R_{11}$  is independently selected from hydrogen, acetyl, and  $C_{1-6}$  alkyl;

$R_{12}$  and  $R_{13}$  are independently selected from hydrogen, hydroxymethyl, trifluoromethyl,  $C_{1-6}$  alkyl,  $C_{1-6}$  alkenyl, bromine, chlorine, fluorine, and iodine;

$R_{14}$  is selected from hydrogen, cyano, carboxy, ethoxycarbonyl, carbamoyl, and thiocarbamoyl; and

each  $W$  is independently selected from hydrogen, bromine, chlorine, fluorine, iodine, amino, and hydroxyl.


**65.** A process according to claim 63, wherein  $L$  is  $OR_z$ , wherein  $R_z$  is selected from:  $C_{1-6}$  alkyl groups,  $C_{1-6}$  aliphatic groups, ~~or~~ aromatic acyl- $C_{1-6}$  groups, saturated or unsaturated alkoxy carbonyl groups, sulphonyl imidazolide, carbonyl imidazolide, aliphatic or aromatic amino carbonyl groups, alkyl imidate groups, saturated or unsaturated phosphinoyl, and aliphatic or aromatic sulphonyl groups.

**66.** A process according to claim 64, wherein  $L$  is  $OR_z$ , wherein  $R_z$  is selected


**74.** A process comprising:

$$\text{R}_y\text{O}_2\text{C}-\text{C}(\text{O})-\text{C}(\text{OH})-\text{C}(\text{S})-\text{C}(\text{O})-\text{OH}$$

(XV)



(XVI)

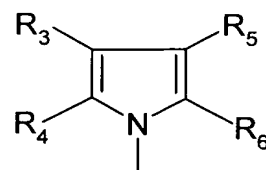
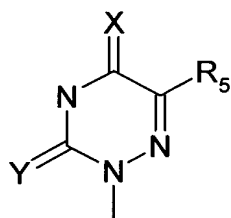
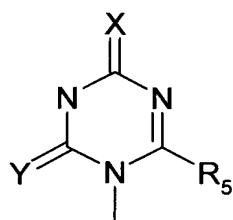
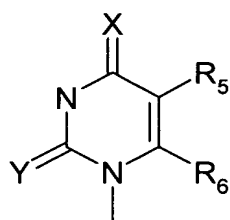
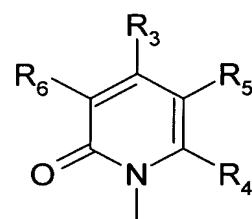
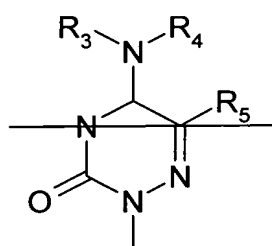
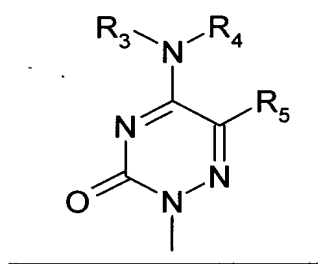
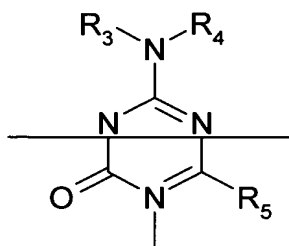
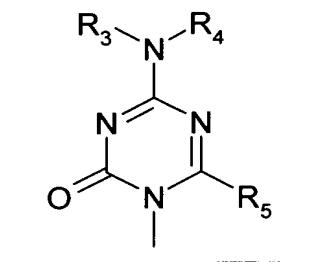


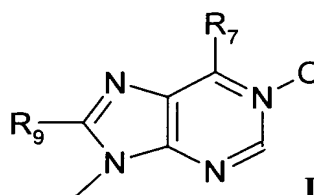
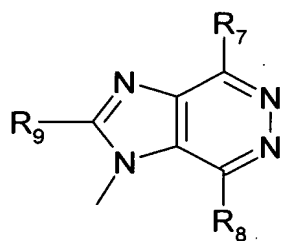
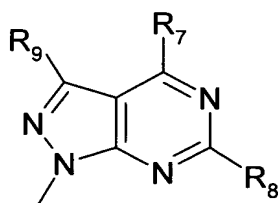
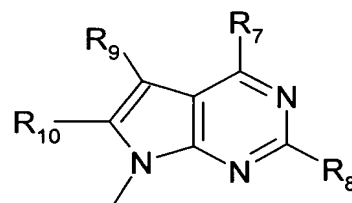
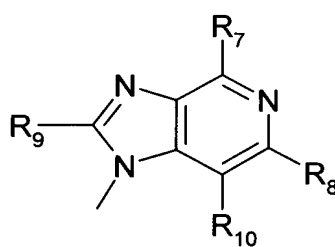
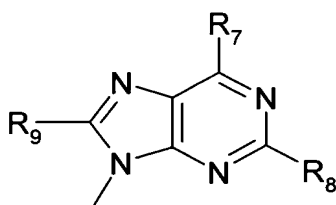
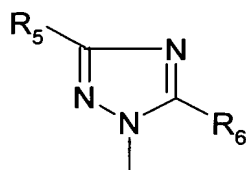
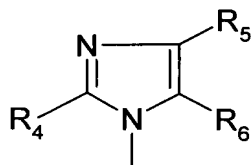
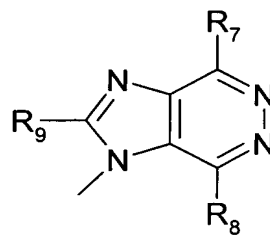
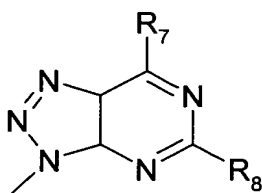
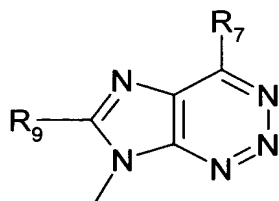
~~(XVI)~~

$$\text{R}_y\text{O}_2\text{C}-\text{C}(\text{O})-\text{C}(\text{R}_2)-\text{C}(\text{Z})-\text{C}(\text{O})-\text{R}_x \quad (\text{XVII})$$

**Z is S;**

O=C1N(R3)C(R4)=C(R5)C(R6)=N1





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X is oxygen or sulfur;

Y is oxygen or sulfur;

R<sub>3</sub> and R<sub>4</sub> are independently selected from hydrogen, hydroxyl, amino, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyl or aracyl;

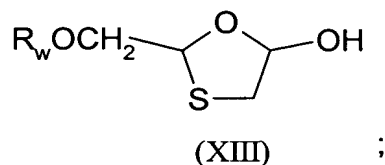
R<sub>5</sub> and R<sub>6</sub> are independently selected hydrogen, halogen, hydroxyl, amino, cyano, carboxy, carbamoyl, alkoxycarbonyl, hydroxymethyl, trifluoromethyl, thioaryl, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy;

R<sub>7</sub> and R<sub>8</sub> are independently selected from hydrogen, hydroxy, alkoxy, thiol, thioalkyl, amino, halogen, cyano, carboxy, alkoxycarbonyl, carbamoyl, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy; and

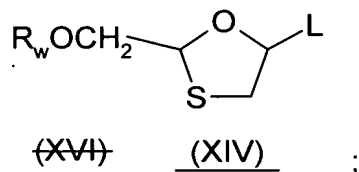
R<sub>9</sub> and R<sub>10</sub> are independently selected from the hydrogen, hydroxy, alkoxy, amino, halogen, azido, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy.

**75. A process comprising:**

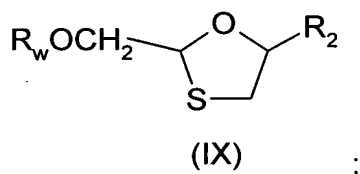
reacting a mercaptoacetaldehyde with a compound of formula R<sub>w</sub>OCH<sub>2</sub>CHO, under neutral or basic conditions, wherein R<sub>w</sub> is hydrogen or a hydroxyl protecting group to obtain a compound of formula (XIII)



converting the hydroxyl of the compound of formula (XIII) to a leaving group L to obtain a compound of formula (XIV):



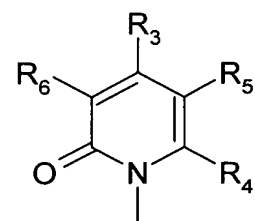
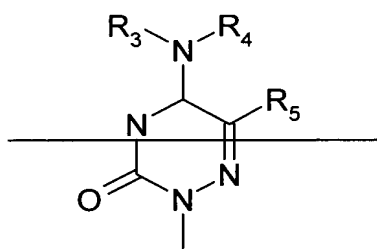
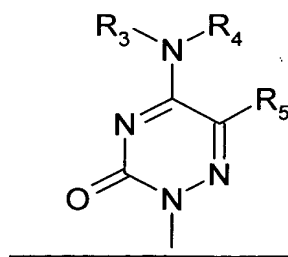
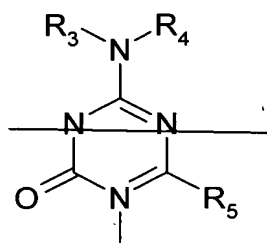
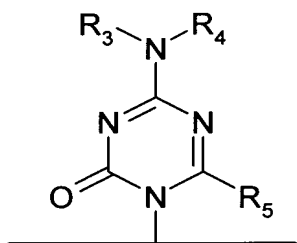
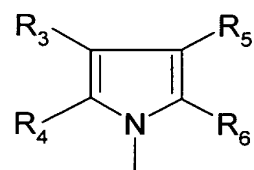
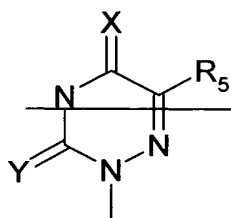
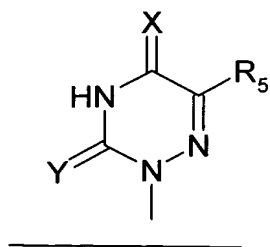
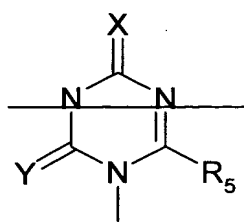
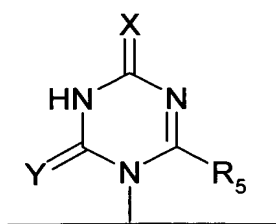
reacting the compound of formula (XIV) with a silylated purine or pyrimidine base or derivative thereof R<sub>2</sub>, in the presence of a Lewis acid, said leaving group is displaced, to produce a compound of formula (IX):



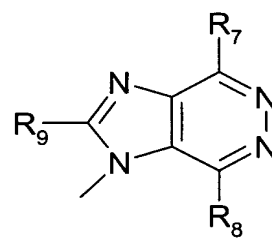
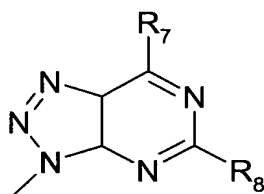
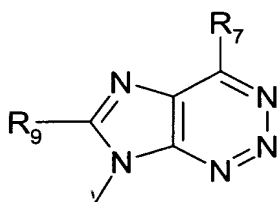
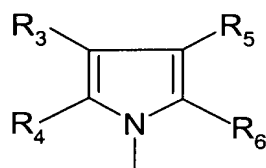
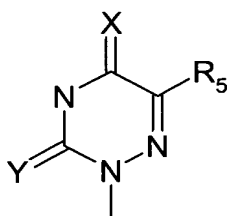
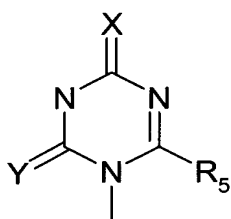
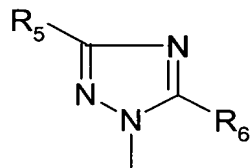
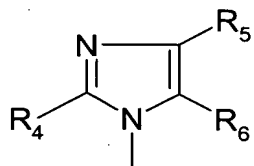
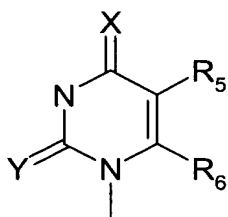
wherein

Z is S, and

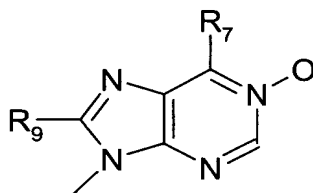
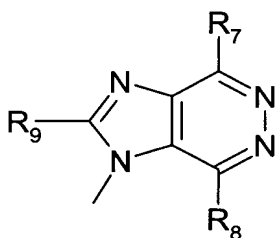
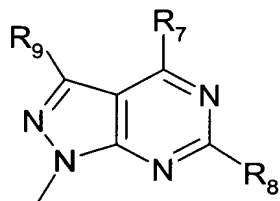
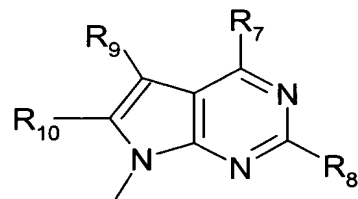
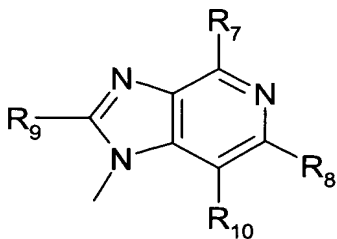
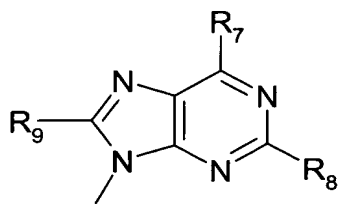
R<sub>2</sub> is selected from the following group:



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X is oxygen or sulfur;

Y is oxygen or sulfur;

R<sub>3</sub> and R<sub>4</sub> are independently selected from hydrogen, hydroxyl, amino, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyl or aracyl;

R<sub>5</sub> and R<sub>6</sub> are independently selected hydrogen, halogen, hydroxyl, amino, cyano, carboxy, carbamoyl, alkoxy carbonyl, hydroxymethyl, trifluoromethyl, thioaryl, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy;

R<sub>7</sub> and R<sub>8</sub> are independently selected from hydrogen, hydroxy, alkoxy, thiol, thioalkyl, amino, halogen, cyano, carboxy, alkoxy carbonyl, carbamoyl, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy; and

R<sub>9</sub> and R<sub>10</sub> are independently selected from the hydrogen, hydroxy, alkoxy, amino, halogen, azido, C<sub>1-6</sub> alkyl, C<sub>2-6</sub> alkenyl, C<sub>2-6</sub> alkynyl, and C<sub>1-10</sub> acyloxy.--

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